Doi: https://doi.org/10.3329/ewmcj.v14i1.83072

Original Article

ASSOCIATION OF HIGH SENSITIVITY C-REACTIVE PROTEIN WITH CHRONIC KIDNEY DISEASE IN TYPE 2 DIABETES MELLITUS PATIENTS

Sonia JN[1], Orin FS[2], Haq MA[3], Rahman HS[4], Sultana N[5]

Article History:
Received: 16th July, 2025
Accepted: 14th August 2025

Abstract

Background: *Chronic kidney disease represents a serious health problem which can lead to progressive loss of kidney function and eventually to end-stage renal disease. In many studies high sensitivity C-reactive protein (hsCRP) has been found as a sensitive marker of low-grade systemic inflammation. Recent studies suggest that patients with CKD suffer from inflammation which deteriorates progressively with increasing levels of renal failure. Objective: To evaluate the association of high sensitivity C-reactive protein with CKD in type 2 diabetes mellitus patients.*

Methods: *A cross sectional study consists of total 153 study subjects were selected from the outpatient department of BIRDEM general hospital.Study subjects were divided into 3 groups, Group-I type 2 DM patients, group-II type 2 DM patients with CKD stage 1-3, group-III type 2 DM patients with CKD stage-4. Patients with CKD Stage 5 were not included in this study. Data was collected directly in the corridor just outside the medical outpatient department. CKD Stage 5 patients were typically not present in the outpatient department, as their treatment usually occurred in the dialysis unit.*

Results: *The mean± SD level of serum hsCRP in group-I, group-II and group-III were 4.44±11.08, 9.89±10.20 and 12.27±12.70 respectively. The results were significantly higher in group-III which is highly significant (P<0.001). The study also revealed that, higher hsCRP was significantly associated with increasing the stage of CKD. There was significant positive correlation of hsCRP with Serum Creatinine and significant negative correlation with eGFR.*

Conclusions: *The present study has concluded that there is significant positive correlation of hsCRP with Serum Creatinine and significant negative correlation of eGFR with CKD in type 2 DM patients. The study also revealed that, higher hsCRP was significantly associated with increasing the stage of CKD.*

Keywords:
C Reactive Protein, CKD, DM

EWMCJ Vol. 14, No. 1, January 2026: 56-60

Introduction

Chronic kidney disease is a worldwide public health problem with an increasing incidence and prevalence with poor outcomes and high expenditures[1]. Chronic kidney disease is defined as decline in kidney function, an estimated glomerular filtration rate (eGFR) of less than 60 mL/min/1.73m^2, or indicators of kidney damage, such as albuminuria or hematuria, or abnormalities found through imaging or laboratory testing that have persisted for at least three months.

1. Dr. Nigar Jahan Sonia; Assistant professor, Department of Biochemistry, Marks Medical College and Hospital, Mirpur-14.E-mail: nigarjahan586@gmail.com; Phone:01671058990
2. Dr. Fatema Shahnaz Orin; Assistant Professor, Department of Community Medicine and Public Health, Kumudini Women's Medical College.
3. Dr. M Azizul Haq, Medical officer, ENT Care Center, Gulshan, Dhaka
4. Dr.Sheikh Hasibur Rahman; Assistant Registrar, Department of Internal Medicine, MAG Osmani Medical College Hospital, Sylhet
5. Dr.Nasima Sultana; Professor & Head, Department of Clinical Biochemistry, BIRDEM Academy, Dhaka

Address of Correspondence: Dr. Nigar Jahan Sonia; Assistant professor, Department of Biochemistry, Marks Medical College and Hospital, Mirpur-14. E-mail: nigarjahan586@gmail.com; Phone:01671058990

CKD is classified into 5 stages based on estimated GFR (eGFR). Stage 1 refers to eGFR ≥ 90 ml/min/1.73m² along with demonstrable kidney damage such as persistence proteinuria, abnormal blood and urine chemistry etc. Next stage 2,3 & 4 corresponds to eGFR of 60-89 ml/min/1.73m², 30-59 ml/min/1.73m² and 15-29 ml/min/1.73m² respectively. CKD Stage 5 is defined as eGFR <15 ml/min/1.73m² which is also known as ESDR (End stage of renal disease). Chronic kidney disease commonly occurs in adult population especially in people with diabetes that progresses over time without a cure and has a high rate of morbidity and mortality [2,3]. Diabetic kidney disease is the most frequent long-term complications affecting-40% of type 2 diabetic patients and is the leading cause of chronic kidney disease and end-stage renal disease [4,5]. Among different inflammatory marker high sensitivity C-reactive protein (hsCRP) is considered as a prime inflammatory marker for CKD in diabetic patients [6]. It is primarily produced and released by liver cells and regulated by IL-6 and TNF-alpha. High sensitivity C-reactive protein is assessed by highly sensitive assay. It is an acute phase protein and sensitive and systemic marker of inflammation[7,8]. CRP is involved in the identification and elimination of foreign substances and damaged cells by binding to phosphocholine, phospholipids, histone, chromatin, and fibronectin receptor. It can trigger the classic complement pathway, as well as it can also activate phagocytes through Fc receptors to facilitate the rapid elimination of cellular debris and damaged or apoptotic cells, as well as foreign pathogens. In some cases, it can also cause tissue damage by activating the complement system and therefore inflammatory cytokines. It plays a role in innate immunity as an early defense system against infections[9,10]. In CKD with type2 DM patient's common pathological characteristics such as inflammation and fibrosis that ultimately lead to decline renal function. Increase level of CRP promote the infiltration of inflammatory cells and the release of cytokines, chemokines, and TGF-â1 from the diseased kidney which lead to progressive renal inflammation and fibrosis [11,12]. High sensitivity C reactive protein is activated by the nuclear factor-kappa b (NF-kb) signaling pathway in CKD which controls numerous pro-inflammatory cytokine[13,14]. Chronic inflammation and mitochondrial dysfunction are increasingly recognized as contributing to kidney fibrosis and ESKD [15]. Since, inflammation seems to play a significant role in development of CKD in type 2 DM patients. So, in this study hsCRP (an inflammatory marker) were evaluated in CKD in type 2 diabetes mellitus patients. The aim was to find out the association of hsCRP with CKD in type 2 DM patients. The outcome of this study suggests that elevated level of hsCRP can be used as a predictive factor of progression of CKD and management guideline in clinical aspects.

Methods

This study was a hospital based cross sectional study conducted at the department of Biochemistry of BIRDEM academy from January 2023 to December 2023. In this study total 153 subjects were selected according to selection criteria from the outpatient department of BIRDEM general hospital. Study subjects weredivided into 3 groups, group- I type 2 DM patients, group-II type 2 DM patients with CKD stage-1-3, group-III type 2 DM patients with CKD stage-4. Patients with CKD Stage 5 were not included in this study. Data was collected directly in the corridor just outside the medical outpatient department. CKD Stage 5 patients were typically not present in the outpatient department, as their treatment usually occurred in the dialysis unit. A structured questionnaire was filled up for each patient to collect data after taking verbal and informed written consent. For the selection of patient's biochemical parameters FBS, HbA1c, Serum Creatinine and eGFR were measured and study parameters GGT and hsCRP were measured and included in the questionnaire. Collected data were checked, processed, edited and analyzed with the help of SPSS[29].

Biochemical analysis: Biochemical measurements of FBS, HbA1C, hsCRP & Serum Creatinine were carried out at the Clinical Biochemistry Department in General Laboratory, BIRDEM General Hospital. Tests were done immediately after blood collection. If delayed, then preserved at 2-8º celcius.

Results

This cross-sectional study was conducted in the Biochemistry Department of BIRDEM Academy. The total sample size was 153, divided into 3 groups 51 in each. Group-I type 2 DM patients, group-II type2 DM with CKD stage 1-3 and group-III type2 DM patients with CKD stage 4. Properly fill up the research questionnaire, blood sample were collected from each study subject and FBS, HbA1c, hsCRP, Serum Creatinine and eGFR were estimated. Statistical

analysis was performed by using the SPSS version 29. The mean±SD and frequency (%) were calculated and the parameters were analyzed by ANOVA test, Chi-square test, Regression analysis test and Pearson's correlation test. The findings are presented in the subsequent pages.

According to table-I, mean age of the patients in group I, II and III were 42.80±8.21, 43.73±8.21 and 45.39±8.88 years respectively.

According to table II, male patients were more in group I (55%), group II (53%) and group III (53%).

According to table III, hsCRP level in group I, II, III was 4.41±11.08, 9.89±10.20 and 12.27±12.70 mg/L respectively. Comparison of biochemical parameters of study population which was highly significant across the groups.

Table IV Shows significant positive association of hsCRP with eGFR and Serum Creatinine between the groups which reveals that progression of disease.

According to figure 1 and 2, there is significant positive association of hsCRP with eGFR and Serum Creatinine between the groups which reveals that progression of disease

Table-I

Age distribution of study subjects (n=153)

variable	Group-I, n-51 mean±SD	Group-II, n-51 mean±SD	Group-III, n-51 mean±SD	p-value
Age(years)	42.80±8.21	43.73±8.21	45.39±8.88	0.3

Values are expressed as mean± SD, P-value is obtained by ANOVA test.
P-value not significant (p≤0.05 significant)

Table-II

Gender distribution of study population (N=153)

Variable	Group-I, n=51		Group-II, n=51		Group-III, n=51		p-value
Gender	Frequency	percentage	Frequency	percentage	Frequency	percentage	
Female	23	45%	24	47	24	47	0.9
Male	28	55%	27	53	22	53	

Values are expressed as frequency (%), P-value is obtained by Chi-square test.
p-value not significant (p≤0.05 significant)

Table-III

Comparison of biochemical Parameters of Study Population (N=153)

Parameter with unit	Group-I, n=51 mean± SD	Group-II, n=51 mean± SD	Group-III, n=51 mean± SD	p-value
hsCRP (mg/L)	4.41±11.08	9.89±10.20	12.27±12.70	<0.001***

Values are expressed as mean± SD, P-value is obtained by ANONA test
***P<0.001(highly significant)

Table-IV

Association of hsCRP with eGFR and Serum Creatinine between the study population

Group	variable	beta	p-value	95%nconfidence interval
Group II-Group-I	eGFR	1.76	<0.001***	2.44
	Serum Creatinine	0.18	<0.01**	0.70
Group III-Group-I	eGFR	3.18	<0.001***	5.97
	Serum Creatinine	0.88	<0.05*	1.37

Analysis was done by multiple logistic regression.
Dependent variable hsCRP
Beta for standardized regression coefficient
*P d"0.05 (significant)
**p<0.01 (moderately significant)
***P<0.001(highly significant)

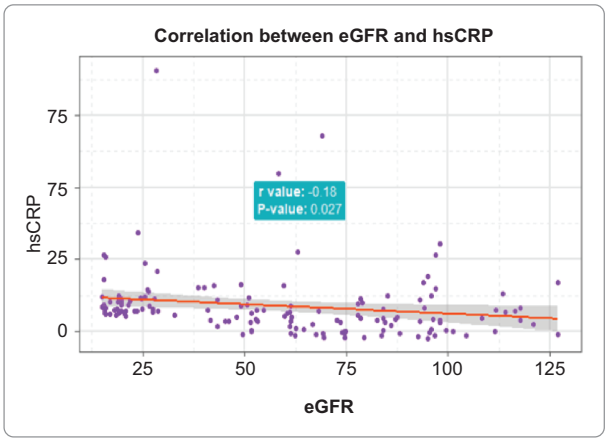

Figure 1: *The scatter diagram shows the correlation of eGFR and hsCRP between the study population (p=0.027, r=-0.18)*

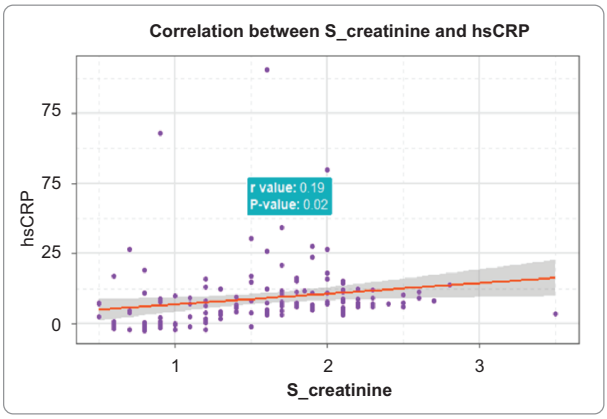

Figure 2: *The scatter diagram shows the correlation of Serum Creatinine and hsCRP between the study population (p=0.02, r=0.19)*

Discussion

Chronic kidney disease (CKD) is a major public health issue globally and the leading cause of death and disability. Day by day it is increasing progressively. Recent studies suggest that patients with CKD patients suffer from inflammation, which deteriorate progressively with increasing levels of renal failure [6]. Hence understanding the factors influencing inflammation is crucial. The present study aimed to investigate the association of high-sensitivity C-reactive protein with CKD in type2 DM patients. In present study association of hsCRP levels with CKD in T2DM patients was shown. A cross sectional study was conducted at the department of Biochemistry of BIRDEM academy from January 2023 to December 2023. In this study total 153 subjects were selected according to selection criteria from the outpatient department of BIRDEM general hospital. Study subjects were divided into 3 groups 51 in each. Group- I type 2 DM patients, group-II type 2 DM patients with CKD stage 1-3 and group-III type 2 DM patients with CKD stage-4. This study found that the mean± SD level of hsCRP were significantly higher in group-III than group-II and in group-II than in group-I ($p<0.001$).The present study found significant positive association of hsCRP levels with Serum Creatinine ($r = 0.19$, $p < 0.05$) and a significant negative association of hsCRP with eGFR ($r = -0.18$, $p < 0.05$), indicating that higher levels of this inflammatory marker are associated with poor kidney function. Previous study done by Tutucu et al. detected that elevated hsCRP had significant negative association with eGFR in type 2 DM patients with CKD but shows the significant positive association with S. Creatinine [16]. This is consistent with previous research suggesting that systemic inflammation plays a crucial role in the development and progression of chronic kidney disease in diabetic patients [13,17]. Another study done by Kalantar-Zadehet al. and Li et al., showed that increase level of CRP promotes the infiltration of inflammatory cells and the release of cytokines, chemokines, and TGF-â1 from the diseased kidney which lead to progressive renal inflammation and fibrosis [3,12]. Therefore, the significant positive association of hsCRP with Serum Creatinine and eGFR as ultimately contributing to the progression of CKD in type 2DM patients. So, much attention should be paid to the increasing level of hsCRP for assessing the development and progression of CKD in type 2DM patients.

Conclusion

In conclusion, the present study showed a strong association of high sensitivity C-reactive protein with CKD in type 2 diabetes mellitus patients. The current study demonstrated that higher level of Serum Creatinine and lower level of eGFR and significantly associated with elevation of hsCRP. These results implied a significant relation between inflammation and kidney function in people with chronic kidney disease associated with established diabetes mellitus. hsCRP was significantly higher in CKD patients with type2 DM patients than without CKD. These parameters also significantly differed in stage-4 CKD than stage 1-3 CKD patients. By advancing our understanding of the relationship between inflammation and kidney function, we can potentially improve clinical outcomes and enhance the quality of life of chronic kidney disease with type2 DM patients. This study can help clinicians

for the optimal management of CKD patients with type 2 DM. This will initiate early treatment as well as to avoid complications.

Acknowledgements
The authors are grateful to the entire staff of department of Biochemistry at Birdem Academy, Dhaka during the study period.

Conflict of Interest
Authors declare no conflict of Interest.

Authors Contributions:
Data gathering and idea owner of this study: Nigar Jahan Sonia

Data design: Fatema Shahnaz Orin, Nigar Jahan Sonia

Data gathering: M Azizul Haq, Nigar Jahan Sonia

Writing and submitting manuscript: Sheikh Hasibur Rahman, Nigar Jahan Sonia

Submission and approval of the final draft: Nasima Sultana, Nigar Jahan Sonia

References

1. Gyurászová, M., Gurecká, R., Bábíèková, J. and Tóthová, L. (2020) "Oxidative stress in the pathophysiology of kidney disease: Implications for noninvasive monitoring and identification of biomarkers," Oxidative medicine and cellular longevity, 2020, p. 5478708. doi: 10.1155/2020/5478708.
2. Grill, A. K. and Brimble, S. (2018) "Approach to the detection and management of chronic kidney disease: What primary care providers need to know," Canadian family physician, 64(10), pp. 728–735.
3. Kalantar-Zadeh, K., Jafar, T.H., Nitsch, D., Neuen, B.L. and Perkovic, V. (2021) "Chronic kidney disease," Lancet, 398(10302), pp. 786–802. doi: 10.1016/s0140-6736(21)00519-5.
4. Hussain, S., Jamali, M.C., Habib, A., Hussain, M.S., Akhtar, M. and Najmi, A.K. (2021) "Diabetic kidney disease: An overview of prevalence, risk factors, and biomarkers," Clinical epidemiology and global health, 9, pp. 2–6. doi: 10.1016/j.cegh.2020.05.016.
5. Siddiqui, K., George, T.P., Joy, S.S. and Alfadda, A.A. (2022) "Risk factors of chronic kidney disease among type 2 diabetic patients with longer duration of diabetes," Frontiers in endocrinology, 13. doi: 10.3389/fendo.2022.1079725.
6. Rapa, S.F, Iorio, D. B.R., Campiglia. P., Heidland, A., Marzocco, S. (2019) "Inflammation and oxidative stress in chronic kidney disease-potential therapeutic role of minerals, vitamins and plant-derived metabolites," International journal of molecular sciences, 21(1), p. 263. doi: 10.3390/ijms21010263.
7. Kanmani, S., Kwon, M. and Kim, M.K. (2019) "Association of C-reactive protein with risk of developing type 2 diabetes mellitus, and role of obesity and hypertension: A large population-based Korean cohort study," *Scientific reports*, 9(1), p. 4573. doi: 10.1038/s41598-019-40987-8
8. Petchiappan, V., Sivakrishna, N. Manickam, S. and Menon, S. (2019) "Glycaemic control and C- reactive protein levels in type 2 diabetes mellitus -how well they co-relate? a prospective study," *International journal of research in medical sciences*, 7(5), p. 1818. doi: 10.18203/2320-6012.ijrms20191683.
9. Bray, C., Bell, L.N., Liang, H., Haykal, R. and Kaiksow, F. (2016) "Erythrocyte sedimentation rate and C-reactive protein measurements and their relevance in clinical medicine," *WMJ: official publication of the State Medical Society of Wisconsin*, 115(6), pp. 317–321.
10. Nehring, S. M., Goyal, A. and Patel, B. C. (2023) C Reactive Protein. StatPearls Publishing.https://www.ncbi.nlm.nih.gov/books/NBK441843/
11. Kanai, R., Nakashima, A., Doi, S., Kimura, T., Yoshida, K., Maeda, S., (2021) "Interferon-ã enhances the therapeutic effect of mesenchymal stem cells on experimental renal fibrosis," Scientific reports, 11(1), p. 850. doi: 10.1038/s41598-020-79664-6.
12. Li, J., Chen, J., Lan, H.Y., Tang, Y. (2023) "Role of C-reactive protein in kidney diseases," Kidney diseases (Basel, Switzerland), 9(2), pp. 73–81. doi: 10.1159/000528693.
13. Liu, C. and Li, C. (2023) "C-reactive protein and cardiovascular diseases: a synthesis of studies based on different designs," *European journal of preventive cardiology*. doi: 10.1093/eurjpc/zwad116.
14. Tang, M., Cao, H., Wei, X-H., Zhen, Q., Liu, F., Wang, Y-F., Fan, N-G. and Peng, Y-D. (2022) "Association between high-sensitivity C-reactive protein and diabetic kidney disease in patients with type 2 diabetes mellitus," *Frontiers in endocrinology*, 13, p. 885516. doi: 10.3389/fendo.2022.885516.
15. Stenvinkel, P., Chertow, M.G., Devarajan, P., Andreoli, S.P., Bangalore, S., Warady, B.A. (2021) "Chronic inflammation in chronic kidney disease progression: Role of Nrf2," Kidney international reports, 6(7), pp. 1775–1787. doi: 10.1016/j.ekir.2021.04.023.
16. Tutuncu, Y., Satman, I., Celik, S., Dinccag, N., Karsidag, K., Telci, A., Genc, S., Issever, H., Tuomilehoto, J. and Omer, B., 2016. "A comparison of hsCRP levels in new diabetes groups diagnosed based on FPG, 2-Hpg, or HbA1c criteria". *Journal of diabetes research, 2016*
17. Pérez-Morales, R.E., Del Pino, M.D., Valdivielso, J.M., Ortiz, A., Mora-Fernández, C. and Navarro-González, J.F., (2019) ''Inflammation in diabetic kidney disease," *Nephron,* 143(1), pp.12-16.

Peer-Review History:
The peer review history for this paper can be accessed here: https://ewmch.com/review/